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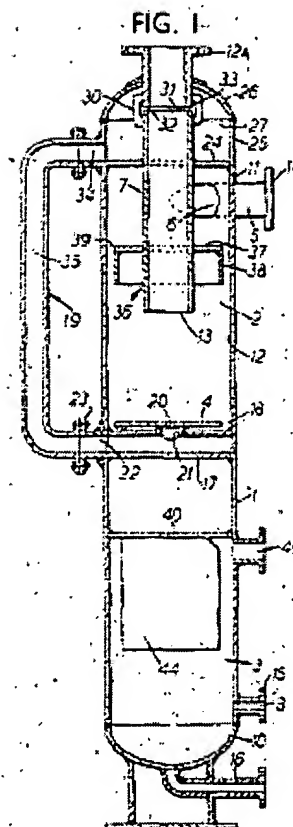
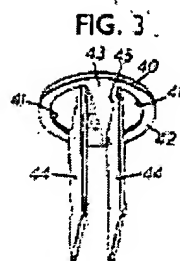
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Abstract of GB1227128

1,227128. Centrifugal separators. PORTA- TEST MFG. Ltd. 23 April, 1968 [24 April, 1967], No. 19067/68. Heading B2P. In a vertical centrifugal separator for separating liquid and gas, Fig. 1, a baffle 4 in the form of a flat solid disc mounted on a tubular support 17 is disposed between a separation chamber 2 and a liquid collection chamber 3. The downwardly spinning vortex of separated gas is prevented by the baffle from entering the chamber 3 and is discharged through a vortex finder 7 while separated liquid collected on the wall of the chamber 2 passes through the gap 18 into the chamber 3. The baffle may alternatively be dished, conical or skirted. The vortex finder is made of two parts interconnected by channel-shaped members 30 and having between them an annular gap 31 communicating with a suction chamber 27 which in turn communicates, via a conduit 19 and openings 21 and 20 in the tubular support 17 and the baffle 24 respectively, with the centre of the gas vortex so that any liquid particle entrained in the vortex finder is sucked out through the gap 31 with some of the gas and recirculated into the separation chamber. A skirted baffle 37 is provided on the vortex finder to prevent any liquid creeping down the vortex finder tube from entering the mouth 13 thereof. A splash disc 40 may, as shown, be disposed in the collection chamber 3 to stop the downward helical flow of separated liquid as it enters the chamber 3, the liquid flowing through openings 41, Fig. 3, in the disc so that any gas entrained in the liquid is concentrated at the top of the chamber 3 and finds its way back into chamber 2. Plates 44 depending from the disc 40 serve to isolate the newly admitted liquid creating a quiescent zone between them. A liquid level float mechanism

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may be threaded in an outlet 46 to regulate the liquid discharge through an outlet 8, the float being conveniently located in the quies- cent zone between the plates 44. Relative dimensions of the different parts are given.

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PATENT SPECIFICATION

(11) 1 227 128

DRAWINGS ATTACHED

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 B2P 10B2A3 10B2E 10B2F 8B



(54) IMPROVEMENTS IN OR RELATING TO CENTRIFUGAL SEPARATORS

- (71) We, PORTA-TEST MANUFACTURING LIMITED, a corporation incorporated in Alberta, Canada, of 6725-104 Street, Edmonton, Alberta, Canada, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- 10 This invention relates to separators. According to the invention, there is provided a separator comprising a vertical shell of circular cross-section, an inlet adjacent the upper end of the shell whereby a mixture of a first component and a second, lighter, component fed into said shell through said inlet is caused to flow along a downward helical path, within said shell about the longitudinal axis of the shell and separates into an inner vortex of substantially the second component and an outer layer of substantially the first component, a vortex finder, for the removal of the second component from the shell, extending into the shell to a level below the inlet, said vortex finder being coaxial with the shell, a baffle member disposed within the shell beneath the lower end of said vortex finder, said baffle member allowing communication between portions of the shell above and below said baffle member whereby the first component can pass into the portion of the shell below said baffle member to be isolated from the influence of said vortex.
- 35 said baffle member including an aperture, the centre of which is substantially coaxial with the longitudinal axis of the shell, the aperture in the baffle member being in communication with the interior of said vortex finder so that the low pressure zone within the vortex is effective to produce suction within said vortex finder for the recovery of any of the first component being drawn through said tube.
- 45 Further according to the invention, there is provided a separator comprising a vertical shell of circular cross-section, an inlet for feeding a mixture of liquid and gas into the upper end portion of the shell to flow in a helical path about the longitudinal axis of the shell towards the lower end portion of the shell for the centrifugal separation of the mixture into an inner vortex of the gas and an outer layer of the liquid, a tubular vortex finder, for the removal of the gas from the shell, extending vertically into the shell to a level below the inlet, said vortex finder being coaxial with the shell and comprising two substantially coaxial sections axially spaced to define a circumferential gap, a baffle member disposed within the shell intermediate the lower end of the vortex finder and the lower end portion of the shell and extending transversely to the longitudinal axis of the shell, said baffle member including an aperture the centre of which is substantially coincident with the longitudinal axis of the shell, said baffle member defining, with the inner surface of the shell, an annular passage to permit the layer of liquid to pass into the lower end portion of the shell, and said baffle member being effective to prevent the vortex from passing into the lower end portion of the shell, and an outlet in the lower end portion of the shell for the removal of the liquid therefrom, the aperture in the baffle member being in communication with the gap in the vortex finder so that the low pressure zone within the vortex is effective to produce suction at the gap for the recovery of liquid moving through the vortex finder.
- Still further according to the present invention, there is provided a separator, for separating a liquid from a gas, comprising a first vertical cylindrical chamber, a suction chamber above said first chamber, an inlet adjacent the upper end of the first chamber for feeding a mixture of liquid and gas therinto, an outlet adjacent the lower

end of said first chamber for removal of liquid therefrom, a conduit connected to the inlet and arranged to feed the mixture tangentially into the chamber to establish a helical flow of the mixture about the longitudinal axis of the first chamber for centrifugal separation of the mixture into an inner vortex of gas component and an outer layer of liquid, a vortex finder for the exhaust of gas from the first chamber extending downwardly through the suction chamber into the first chamber to a level below the inlet, said vortex finder being coaxial with the first chamber and comprising two substantially coaxial conduit sections maintained in spaced-apart relation within the suction chamber to define a circumferential gap, a baffle member disposed within the first chamber beneath the lower end of the vortex finder and extending transversely to the longitudinal axis of the first chamber, said baffle member including an aperture the centre of which is substantially coincident with the longitudinal axis of the first chamber and said baffle member having a diameter less than the diameter of the chamber whereby the liquid can pass from the portion of the first chamber above the baffle member to the portion of the first chamber below the baffle member to be removed from the influence of the vortex, and a sealed conduit connecting the suction chamber and the aperture in the baffle member whereby the low pressure zone within the vortex is effective to provide suction at the gap for the recovery of liquid moving through the vortex finder, the ratio of the diameter of the aperture in the baffle member to the interior diameter of the vortex finder being between 0.2 and 0.4 and the ratio of the cross-section area of the circumferential gap in the vortex finder to the cross-sectional area of the aperture in the baffle member being between 0.2 and 2.0.

Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings in which:

Figure 1 is a cross-sectional view of a centrifugal separator in accordance with the invention;

Figure 2 is a crosssection, partly diagrammatic, of the separator shown in Figure 1 and illustrating the operation of a recirculation assembly of the separator of Figure 1;

Figure 3 is an isometric view of an isolation plate assembly of the separator;

Figure 4 is an isometric view to an enlarged scale of a portion of a vortex finder gap assembly;

Figure 5 is a graph showing the relationship of the ratio of flow through a baffle member aperture over flow through the vortex finder to the ratio of the baffle member

aperture diameter to the vortex finder inner diameter; and

Figure 6 is a view identical to Figure 1 but lettered to indicate particular dimensions.

Referring now to Figure 1, a centrifugal separator in accordance with this invention includes a shell 1 defining a first chamber comprising an upper separator chamber 2 and a lower liquid collection chamber 3. A baffle member 4 is disposed intermediate the chambers 2, 3. Conduit 5 is connected to inlet 6 leading into the upper portion of separation chamber 2. Vortex finder 7 extends through the top closure of shell 1 into separation chamber 2. An outlet 8 leading from collection chamber 3 is provided.

Shell 1 comprises a vertical, vessel of cross-section having top and bottom closure respectively provided by caps 26, 10 fastened as by welding to the ends of shell side wall 11. Shell 1 is elongated in configuration and the inner side wall surface 12 is smooth to provide unobstructed flow of liquid thereon. It is constructed of standard separator material, usually steel, selected to withstand the pressures and stresses of service.

Vortex finder 7 extends downwardly through top cap 26 into separation chamber 2. It is co-axial with the longitudinal axis of shell 1. A flange 12A is provided at its upper end for connection with a gas collection line (not shown). The vortex finder 7 is secured in place as by welding to provide a pressure tight seal between its circumferential surface and top cap 26.

Horizontal conduit 5 intersects vertical side wall 11 tangentially and communicates through inlet 6 with separation chamber 2 at a point adjacent the chamber's upper end and above the inlet 13 of vortex finder 7. Conduit 5 and inlet 6 are thereby adapted to direct feed mixture tangentially onto the inner side wall surface 12 to establish a downward helical flow of the mixture about the longitudinal axis of shell 1. Conduit 5 is provided with a flange 14 for connection to a source (not shown) of feed mixture.

The outlet 8 formed in side wall 11, is provided for the discharge of liquid from collection chamber 3. Outlet 8 is provided with a flange 15 for connection with conventional means (not shown) for regulating the rate of discharge. Flanged drain outlet 16 is provided, leading from the bottom of cap 10, for the removal of solids or heavy liquid components collected therein.

Baffle member 4 comprises a flat, horizontal disk. It is mounted on tubular support 17, which extends transversely across the interior of shell 1. Support 17 is secured at its ends to inner surface 12 as by welding. Baffle member 4 is centrally disposed within

shell 1 and is of lesser diameter than the shell interior. Gap 18 is thereby defined between the edge of baffle member 4 and inner surface 12.

5 A number of differently shaped members could be substituted for baffle member 4 to carry out its functions. For example, the baffle could be dish or conical or skirted. However, in order to allow uninterrupted
10 flow of liquid past the baffle, the gap 18 should extend completely around the baffle.

A recirculation assembly 19 is incorporated within the separator. To this end, there is provided an aperture or opening 20
15 in baffle member 4, and a complete, circumferential gap 31 in vortex finder 7 at a point outside shell 1, the opening 20 and gap 31 being in communication.

In greater detail, baffle member 4 is
20 formed to define opening 20, co-axial with the longitudinal axis of vortex finder 7. Tubular support 17 is connected through tubular collar 21 to opening 20 and provides a conduit from opening 20 through
25 aperture 22 in side wall 11. A flange 23 is welded to the end of tube 17 extending through side wall 11 at aperture 22. A plate 24 is fastened around its circumference to inner surface 12 as by welding to provide a
30 pressure tight seal. The cap 26 defines, with the portion 25 of the shell above the plate 24, a suction chamber 27. The vortex finder 7, which extends downwardly through the cap 26 and plate 24, is welded circumferentially to the plate 24 to provide a pressure
35 tight seal. The vortex finder 7 is formed in two sections 28, 29 which are maintained by blocks 30 in co-axial, spaced-apart relation to define a gap 31. The gap 31 is located
40 within suction chamber 27; that is, at a point outside the chamber 2. For best performance of the assembly 19, upper vortex finder section 28 has a slightly smaller inner diameter than lower vortex finder section 29
45 whereby an overhang 32 is provided, (see Figure 5). Overhang 32 helps to prevent droplets of liquid within vortex finder 7 being carried across gap 31. Blocks 30 are formed with an indented channel 33 adjacent gap 31 to form a saddle so that there is no blockage of the gap 31. Blocks 30 are
50 secured to sections 28, 29 as by welding. A flanged outlet 34 is provided from suction chamber 27. Flanged outlet 34 is connected, through pipe 35, to flange 23 of tube 17. The vortex finder gap 31 and baffle plate opening 20 are therefore in communication.

A skirted baffle 36 is mounted on vortex finder 7 at a point spaced below feed inlet
60 6. It comprises a flat, outwardly extending member 37, secured to vortex finder 7, and a downwardly extending skirt 38, the outer edge of member 37 is spaced inwardly from the shell inner surface 12 whereby an annular passage 39 is defined between skirt 38
65

and surface 12.

A horizontal splash ring 40 is disposed within collection chamber 3. Splash ring 40 comprises a plate, fastened around its
70 circumferential edge to the inner surface of side walls as by welding. Splash ring 40 is provided with openings 41, Fig. 4 to leave a circular shoulder 42 and a central span 43. Communication is available between the
75 portions of collection chamber 3 above and below ring 40 through the openings 41 therein.

Parallel, rectangular isolation plates 44 are connected to and are suspended from the edges 45 of span 43. Plates 44 serve to
80 define a quiescent zone between them within collection chamber 3.

A threaded or flanged float outlet 46 is provided in side wall 11 at a point adjacent to and below splash ring 40. A conventional
85 liquid level float (not shown) may be threaded into outlet 46 to control the regulation of liquid discharge through outlet 8.

A mixture A fed to the separator through
90 inlet 6 includes a gas component and at least one liquid component. For example, the mixture may include gas, oil and water. In addition, the mixture will often include incidental amounts of solids, such as sand.
95

In operation, the mixture A is fed, under pressure, through conduit 5 and inlet 6 into separation chamber 2. Due to tangential intersection of conduit 5 with side wall 11, mixture A will be induced to spin in a
100 downward helical flow around the longitudinal axis of shell 1. An immediate separation of gas from liquid will commence.

Due to the centrifugal forces acting on it, the liquid phase will move outwardly
105 and form a liquid layer B on inner side wall surface 12. Liquid layer B will rotate downwardly while remaining spread out upon surface 12. As illustrated in Figure 1, the downwardly spinning gas vortex C
110 converges toward centre, turns upward at D, and forms an upwardly spinning vortex E which moves into the inlet 13 of vortex finder 7 and is exhausted from shell 1 via vortex finder 7. The spinning of the gas
115 causes a lower pressure zone to exist at the axis than at surface 12, and it has been found necessary to provide means to prevent the liquids in collection chamber 3 from being sucked up into the low-pressure
120 centre of the gas vortex and being partially exhausted with the gas. Baffle member 4 provides such a means by isolating the quiet region below it from the gas vortex above it.

Any liquid in separation chamber 2
125 which does not spin and is thus not subject to centrifugal forces tends to be drawn toward the low pressure centre of the gas vortex. This effect occurs on all surfaces that
130

lead toward centre. Thus a thin film of liquid creeps from the inlet 6 of separation chamber 2 upward and across cap 9 to the outer surface of vortex finder 7 and thence
5 downward and into inlet 13 of vortex finder 7 from whence it is undesirably lost or "carried over" with the gas.

The recirculation assembly 19 is incorporated to prevent the carry-over loss. A
10 zone of low pressure exists along the longitudinal axis of gas vortex C. By centering the vortex C within chamber 2 to coincide with baffle member opening 20, suction may be exerted through the conduit system
15 connecting it to vortex finder gap 31. In a manner comparable to that of a vacuum cleaner, the suction exerted at gap 31 draws any carry over liquid from the interior of vortex finder 7 and feeds it back into gas
20 vortex C via outlet 34, conduits 35 and 17 and opening 20. The bulk of the recovered liquid is then flung by centrifugal action out to liquid layer B in the vicinity of baffle member 4.

25 Centering of gas vortex C within separation chamber 2 may be accomplished in several ways. For example, a symmetrical arrangement of opposed tangential feed inlets will accomplish this aim.

30 We have found that a single tangential inlet and feed conduit tends to cause the longitudinal axis of the gas vortex C to deviate from the longitudinal axis of shell 1. Skirted baffle 36 serves to maintain vortex
35 C in an upright and centered position. Therefore, when combined with skirted baffle 36, a single tangential inlet and feed conduit may be used satisfactorily. Skirted baffle 36 also tends to reduce the amount of
40 liquid that creeps to inlet 13 of vortex finder 7.

Liquid layer B, containing a small amount of entrained gas, passes through baffle gap 18 and is collected in collection
45 chamber 3. Upon entering chamber 3, layer B is moving with a downward helical flow. To prevent it from agitating the collected liquid and entraining gas deeply therein, it is preferable to alter the direction of its
50 flow. Splash ring 40 carries out this function. The downward flow is halted by transverse shoulder 42 and the liquid spills through openings 41 into the lower portion of chamber 3. As a result, the entrained
55 gas is concentrated adjacent the upper surface of the collected body of liquid. The gas may easily break out and gradually work its way back into the separation chamber 2 where it will be caught up in gas
60 vortex C and be exhausted.

The liquid which passes through splash ring openings 41 will still have a degree of turbulence. Isolation plates 44 serve to segregate the newly admitted liquid, creating a
65 quiescent zone in the space between them.

If a float mechanism is to be used to control the rate of discharge from chamber 3, the float may advantageously be located between the plates 44.

The liquid collected in chamber 3 may
70 be discharged from collection chamber 3 on a periodic or continuous basis, depending on the nature of the control equipment used. If only a single component liquid is collected, it may be discharged through out-
75 let 8. If a liquid with non-miscible components is collected, the components will separate by gravity into layers. Appropriate outlets may be provided in side wall 11 to draw the components off separately as de-
80 sired.

We have found that certain dimensional relationships should exist between elements of the separator in order to obtain optimum
85 performance.

The ratio of the diameter of baffle member opening 20 to the interior diameter of vortex finder 7 should preferably be between .1 and .5 for successful operation of recirculation assembly 19. Figure 6 shows a
90 plot of the ratio of gas flow through baffle members opening 20 over the gas flow through vortex finder 7 against the ratio of the diameter of baffle member opening 20 over the diameter of vortex finder inlet 13.
95 It will be noted from the plotted curve that the operational range of recirculation assembly 19 is between .1 and .5 while the range of best operation is between about .2 and .4. The baffle member opening 20 and the conduit defined by vortex finder 7 have been described hereinabove as being circular. The aforementioned ratio is, therefore, expressed in terms of diameters. It
100 will be appreciated that these openings can have other configurations, such as a polygonal configuration, although the circular configuration will be preferred. The word "diameter" as used with regard to the said ratio is therefore to be given a
105 broad meaning so as to include the major dimension across the openings whether they are circular or only generally circular in configuration.

The ratio of the cross-sectional area of the vortex finder gap 31 to the cross-sectional area of the baffle member opening 20 preferably should be between 0.2 and 2.0. We have found that best performance of the recirculation assembly 19 occurs when the
110 gap 31 and opening 20 are roughly equal in cross-sectional area.

The cross-sectional area of baffle member 4 preferably should be at least 1/2 the cross-sectional area of the interior of shell 1. If
115 baffle member 4 is too small, excessive disturbance of the collected liquid will occur. If baffle member 4 is too large, of course, it will interfere with the flow of liquid layer B. Sufficient allowance must
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be made between inner surface 12 and the outer edge of baffle member 4 to permit layer B to pass therethrough.

Smoothing sleeve skirt 38 should preferably be at least twice as long as the width of annular passage 39. Observations indicate that the centering action of smoothing sleeve 36 is optimized when a long, narrow annular passage 39 is provided.

The size of the separator will be determined primarily by the allowable pressure drop across it at a given rate of throughput. The separator will have a characteristic resistance to flow, analogous to the characteristic of a meter orifice plate. We have developed formulas and dimensional relationships which may be used to design an efficient separator in accordance with this invention. These formulas and relationships are not to be considered as limitations on the invention since they may be departed from without seriously affecting the separator operation. They are provided as a guide useful in designing an efficient embodiment. The formulas and relationships, using the symbols shown in Figure 6 to identify dimensions, are as follows:

$$1. C=345Q/\sqrt{GZT}$$

Where: Q =flow rate, MMCF (million cubic feet)/day
 C =separator coefficient
 G =gas gravity
 Z =gas compressibility factor
 T =temperature ° Rankin
 dP =pressure drop across separator, psig.
 p =static pressure at inlet, psia

$$2. d=.33/\sqrt{C} \text{ inches}$$

$$3. \begin{array}{ll} h=2.3 d & a=.32 d \\ i=.27 d & b=.86 d \\ v=.33 d & e=.03 d \\ n=.25 v & x=d \\ r=.50 v & z=.50 d \\ y=.80 d & \end{array}$$

This embodiment of the invention will now be illustrated by the following example:

EXAMPLE I

A centrifugal separator conforming to that illustrated in Figure 6 was constructed of steel. The separator was to be used in conjunction with an oil well located in Alberta. Maximum daily production from the well was known to be:

13.6 MMcf/day of gas
 80 BBL/day of oil
 98 BBL/day of salt water

Other known factors were:

Allowable pressure drop across separator 5 psi.

Gravity of the gas .7.

Compressibility factor of the gas .86.

Temperature of the mixture 580°R.

Inlet static pressure 1000 psia.

Using the guide formulas given hereinabove, a separator having the following dimensions was built:

$d=11.6$ inches $n=1.00$ inches
 $h=26.5$ inches $r=1.94$ inches
 $x=.12$ inches $a=3.50$ inches
 $y=10$ inches $b=0.62$ inches
 $z=6$ inches $c=.37$ inches
 $i=2.90$ inches $v=4.02$ inches

The separator was installed at the oil well and hooked up in such a manner as to enable determination of the amount of liquid remaining in the gas from the separator.

Production from the well was fed to the separator, and it was determined that .06% of the total liquids entering the separator remained in the gas leaving the separator.

The remaining dimensions of the separator can be calculated by the optimum design relationships given hereinabove.

WHAT WE CLAIM IS:—

1. A separator comprising a vertical shell of circular cross-section, an inlet adjacent the upper end of the shell whereby a mixture of a first component and a second, lighter, component fed into said shell through said inlet is caused to flow along a downward helical path within said shell about the longitudinal axis of the shell and separates into an inner vortex of substantially the second component and an outer layer of substantially the first component, a vortex finder, for the removal of the second component from the shell, extending into the shell to a level below the inlet, said vortex finder being coaxial with the shell, a baffle member disposed within the shell beneath the lower end of said vortex finder, said baffle member allowing communication between portions of the shell above and below said baffle member whereby the first component can pass into the portion of the shell below said baffle member to be isolated from the influence of said vortex, said baffle member including an aperture, the centre of which is substantially coaxial with the longitudinal axis of the shell, the aperture in the baffle member being in communication with the interior of said vortex finder so that the low pressure zone within the vortex is effective to produce suction within said vortex finder for the recovery of any of the first component being drawn through said tube.

2. A separator according to claim 1 wherein said vortex finder comprises two substantially coaxial sections axially spaced to define a circumferential gap, said gap being located within a chamber through which said vortex finder extends, and

wherein a conduit extends between said chamber and the aperture in the baffle member.

3. A separator according to claim 2 wherein said chamber is located within said shell above the inlet.

4. A separator according to claim 2 or claim 3 wherein the ratio of the diameter of the aperture in the baffle member to the interior diameter of said tube is between 0.1 and 0.5.

5. A separator according to any one of claims 2 to 4 wherein the ratio of the cross-sectional area of the circumferential gap in said tube to the cross-sectional area of the aperture in the baffle member is between 0.2 and 2.0.

6. A separator comprising a vertical shell of circular cross-section, an inlet for feeding a mixture of liquid and gas into the upper end portion of the shell to flow in a helical path about the longitudinal axis of the shell towards the lower end portion of the shell for the centrifugal separation of the mixture into an inner vortex of the gas and an outer layer of the liquid, a tubular vortex finder, for the removal of the gas from the shell, extending vertically into the shell to a level below the inlet, said vortex finder being coaxial with the shell and comprising two substantially coaxial sections axially spaced to define a circumferential gap, a baffle member disposed within the shell intermediate the lower end of the vortex finder and the lower end portion of the shell and extending transversely to the longitudinal axis of the shell, said baffle member including an aperture the centre of which is substantially coincident with the longitudinal axis of the shell, said baffle member defining, with the inner surface of the shell, an annular passage to permit the layer of liquid to pass into the lower end portion of the shell, and said baffle member being effective to prevent the vortex from passing into the lower end portion of the shell, and an outlet in the lower end portion of the shell for the removal of the liquid therefrom, the aperture in the baffle member being in communication with the gap in the vortex finder so that the low pressure zone within the vortex is effective to produce suction at the gap for the recovery of liquid moving through the vortex finder.

7. A separator, for separating a liquid from a gas, comprising a first vertical cylin-

drical chamber, a suction chamber above said first chamber, an inlet adjacent the upper end of the first chamber for feeding a mixture of liquid and gas thereinto, an outlet adjacent the lower end of said first chamber for removal of liquid therefrom, a conduit connected to the inlet and arranged to feed the mixture tangentially into the chamber to establish a helical flow of the mixture about the longitudinal axis of the first chamber for centrifugal separation of the mixture into an inner vortex of gas component and an outer layer of liquid, a vortex finder for the exhaust of gas from the first chamber extending downwardly through the suction chamber into the first chamber to a level below the inlet, said vortex finder being coaxial with the first chamber and comprising two substantially coaxial conduit sections maintained in spaced-apart relation within the suction chamber to define a circumferential gap, a baffle member disposed within the first chamber beneath the lower end of the vortex finder and extending transversely to the longitudinal axis of the first chamber, said baffle member including an aperture the centre of which is substantially co-incidental with the longitudinal axis of the first chamber and said baffle member having a diameter less than the diameter of the chamber whereby the liquid can pass from the portion of the first chamber below the baffle member to be removed from the influence of the vortex, and a sealed conduit connecting the suction chamber and the aperture in the baffle member whereby the low pressure zone within the vortex is effective to provide suction at the gap for the recovery of liquid moving through the vortex finder, the ratio of the diameter of the aperture in the baffle member to the interior diameter of the vortex finder being between 0.2 and 0.4 and the ratio of the cross-sectional area of the circumferential gap in the vortex finder to the cross-sectional area of the aperture in the baffle member being between 0.2 and 2.0.

8. A separator substantially as hereinbefore described with reference to the accompanying drawings.

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Lyon House, Lyon Road,
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Agents for the Applicants.

1,227,128

4 SHEETS

COMPLETE SPECIFICATION

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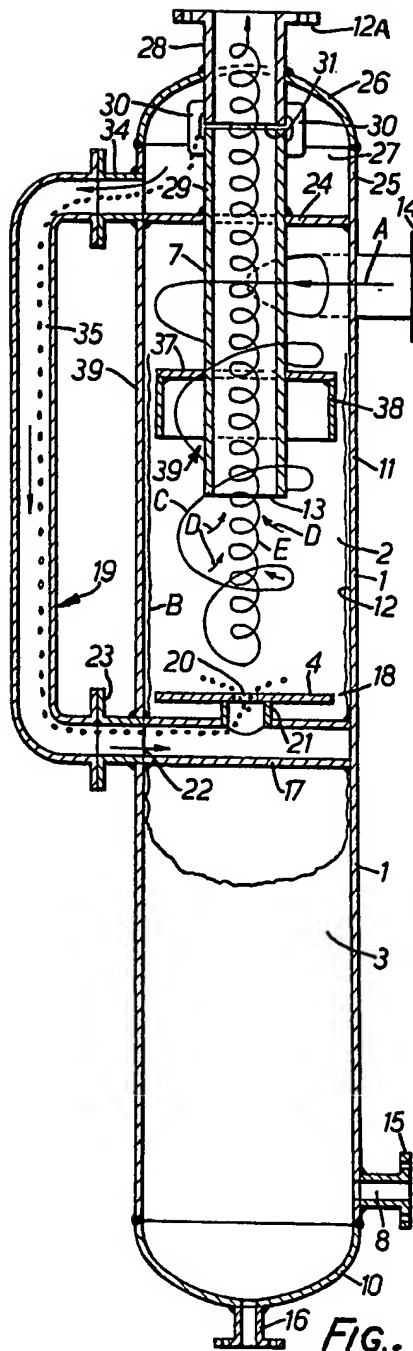


Fig. 2

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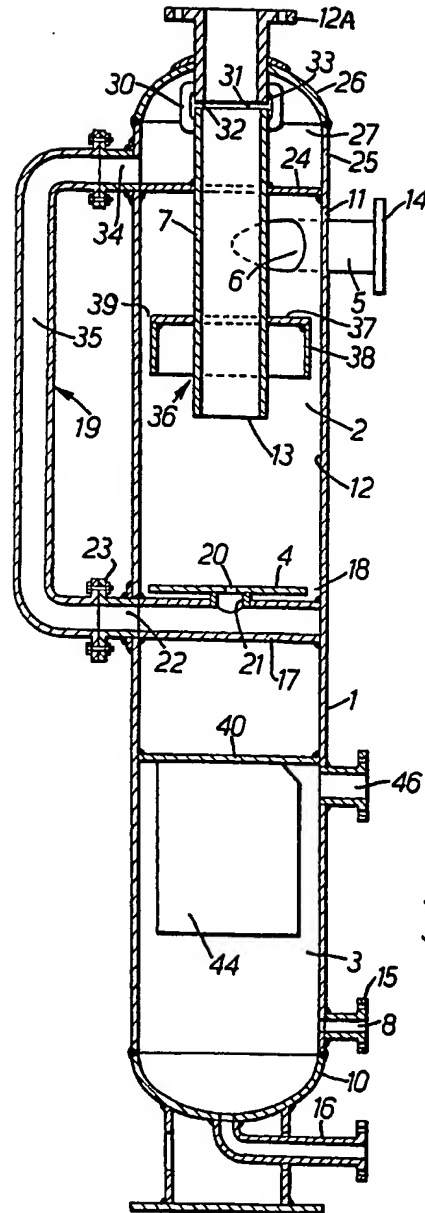


FIG. 1

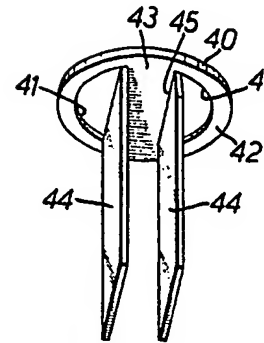


FIG. 3

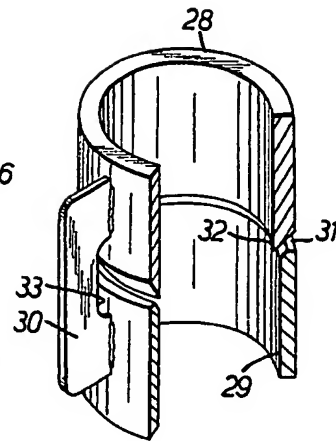


FIG. 4

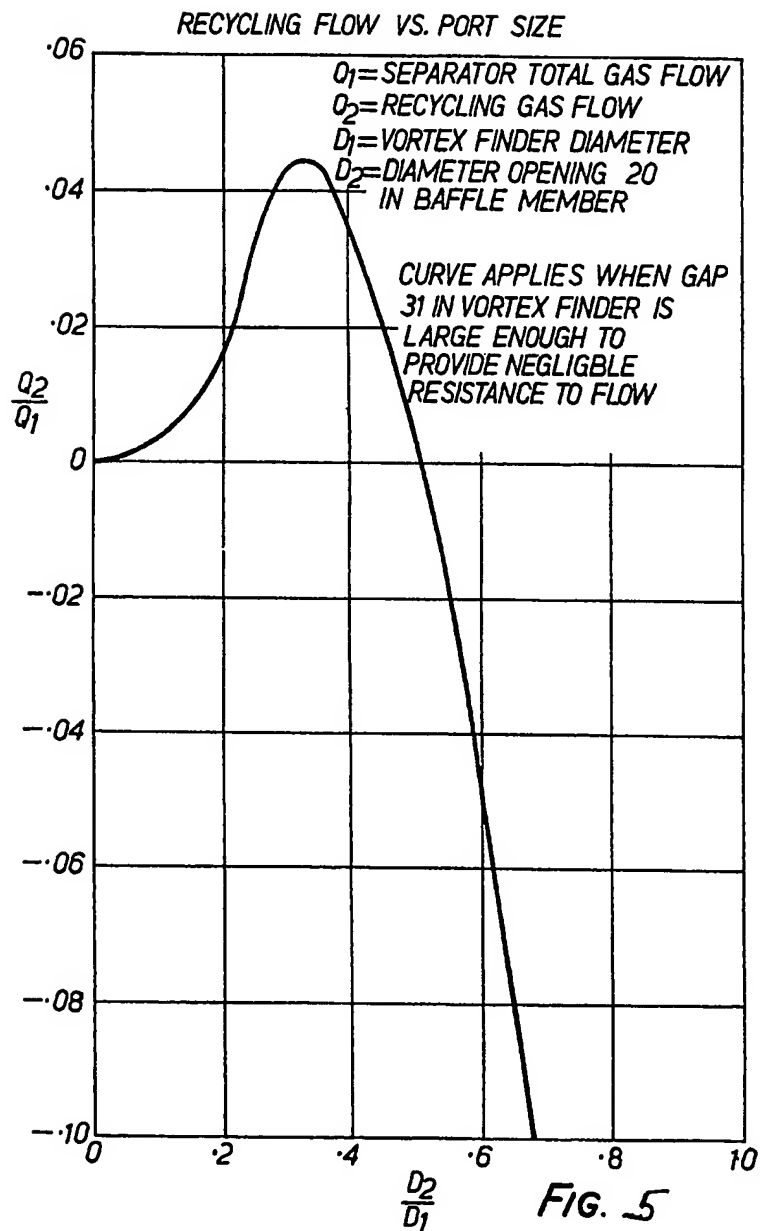
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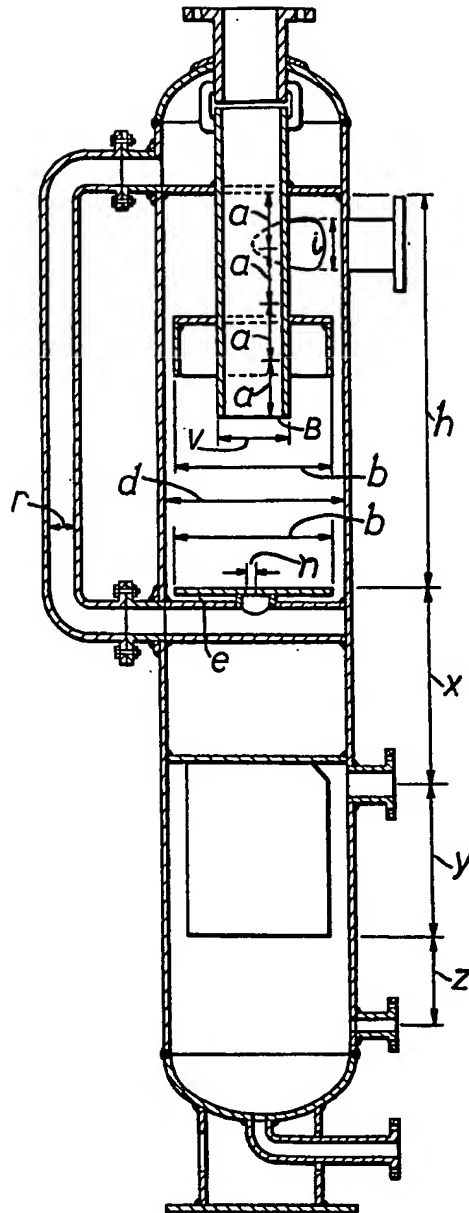


FIG. 6

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